MARINE SCIENCE FROM CARTOGRAPHIC VIEWPOINT
FROM RESEARCH TO EDUCATION IN HUNGARY

Mátyás MÁRTON

Department of Cartography and Geoinformatics,
Eötvös Loránd University, Budapest, Hungary
terkepmuhely@t-online.hu

TENGERTAN TÉRKÉPÉSZ SZEMMEL
A KUTATÁSTÓL AZ OKTATÁSIG MAGYARORSZÁGON

Összefoglalás

Két és fél évtizedes magyar kutatások, valamint a témához kapcsolódó külföldi szakirodalom magyar adaptációja és szintézise eredményeképpen, ma már korszerű és elegendő tudással rendelkezünk ahhoz, hogy a tengerfenéknek a szárazföldek leíróföldrajzához hasonló részletességű leírását adjuk. Ez adta az ötletet, hogy kurzust szervezzünk a Miskolci és a Szegedi Egyetemen „Tengertan I. – Morfológia", illetve „Tengertan térképész szemmel" címmel. Jelen tanulmányban összegzem kutatásaim történetét, hálás tisztelettel Klinghammer István professzor úrnak. A tudományos munkásságomhoz kapcsolódó sikerek két időszakra és két különböző hasznosítási területre oszthatók.

Az első időszakban (1974–90) az eredmények gyakorlati hasznosulása jellemző, nem véletlenül, hiszen ekkor a Kartográfiai Vállalat munkatársa voltam. Míg a második – nagyjából az 1990-es évek elején elkezdődött – időszakban az ELTE oktatójaként a kutatás áttevődött az egyetemre, hallgatók bevonásával folyt, de az ezredforduló elejéig „csak" nemzetközi visszhangot is kiváltó elméleti eredmények születtek, az eredmények ugyan folyamatosan beépültek az oktatásba, azonban „látványosabb hasznosításuk" különböző kiadványokban csak 2003 és 2004 folyamán valósulhatott meg.

Szükségesnek látom azonban a fizikai oceanográfia eredményeinek térképi szintézisét, összegzését és „honosítását" is. A 2004-ben a Topográf–Nyír-Karta kiadta „Nagy Világatlaszba" elkészítettem a 32 oldalas TENGERFENÉK-DOMBORZAT című fejezetet. A kiadóval további 40 oldalnyi tematikus térképpel kibővített kiadásról tárgyalunk, a felsőoktatás és a doktorképzés számára.

Summary

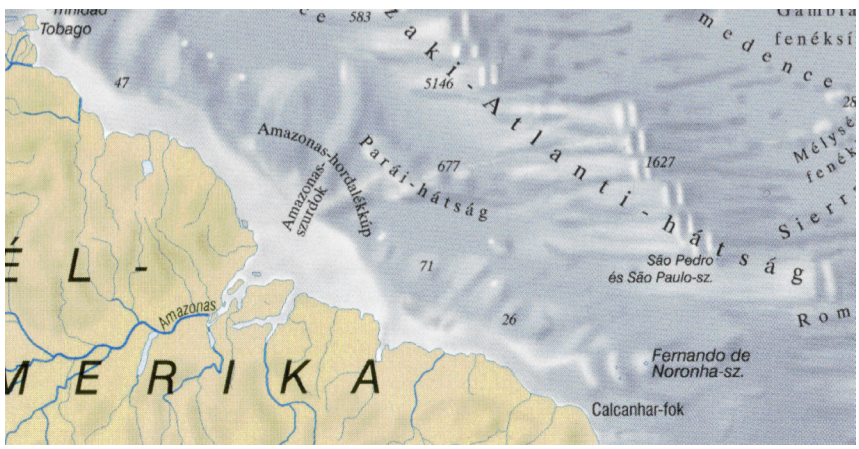
After having pursued research of marine science for two and half decades, and after having synthesized international literature on this discipline and adapted it to the Hungarian language, we are in possession of a level of modern knowledge sufficient to give a detailed and adequate description of the seafloor, similar to descriptive geography of continents. This gave us the idea to organize a course at the University of Miskolc and Szeged as well with the titles „Marine Science I – Morphology"and „Marine Science from Cartographic Viewpoint". This paper gives a summary of the history of this research, with grateful respects to Professor István Klinghammer.

My achievements in research can be divided in two periods fundamentally different in practical respect. In the first period (1974–90), when I was working for the Kartográfiai Vállalat, my results were typically utilized in practice. During the second period, which began in the early 1990s, being a lecturer at Eötvös Loránd University, I transferred my research to the university, where several students joined the project. Until the first years of the new millennium, we could „only" achieve theoretical results; although these results elicited international reaction and were incorporated in education, they could be utilized in various publications „spectacularly" only during 2003 and 2004.

I also find the cartographical synthesis, summary and „nationalization" of results of physical oceanography important. I prepared a chapter of 32 pages with the title „Seafloor Relief", which was published in 2004 by Topográf–Nyír-Karta in their „Great World Atlas". We are negotiating with the publishing company about a more comprehensive publication including 40 new pages of thematic maps for the university and postgraduate training.

Introduction

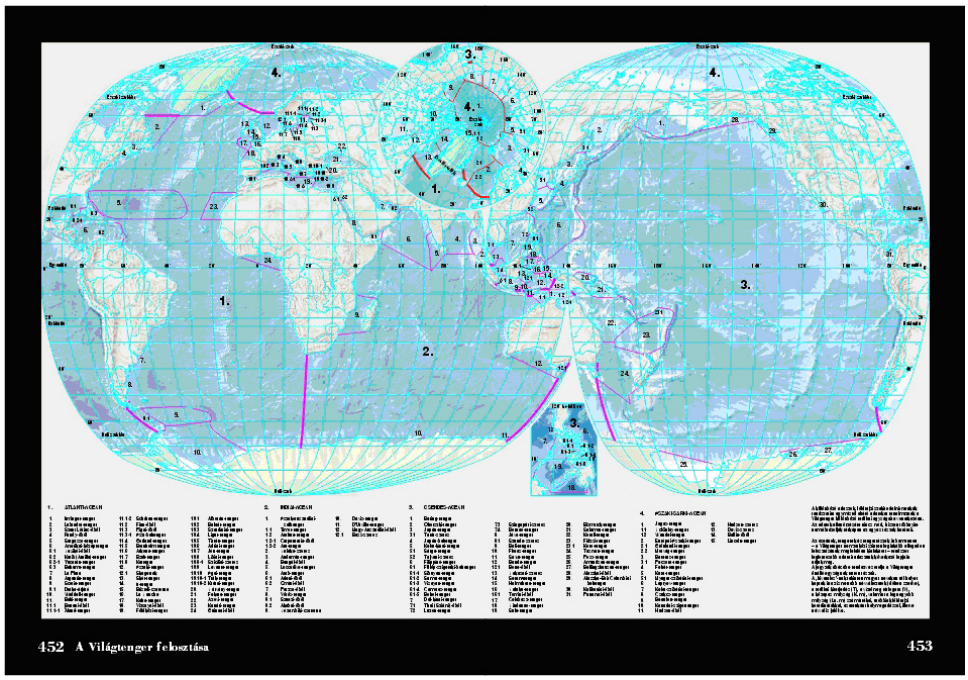
As Hungary had lost its exit to the sea because of the Trianon (Paris/Versailles) treaty in 1920, the community of Hungarian scientists also lost its interest in actualization and amplification of geographical and cartographical knowledge related to oceans and seas for several decades. Fortunately, this situation is changing. In 1999, *Rudolf Czelnai* published his work *The World Ocean* (*A világóceán*), with the subtitle *Modern physical oceanography* (*Modern fizikai oceanográfia*). The last volume of *Continent to Continent* (*Kontinensről kontinensre*) series, richly illustrated with maps and photos, *András Galácz*'s work *Oceans and Polar Regions* (*Óceánok–Sarkvidékek*), was published in the first half of 2003; I also took part in the preparation of its map illustrations and the compilation of its appendix. I was the author of the 32 page chapter *Submarine topography with maps, descriptions and data* (*Tengerfenék-domborzat térképekkel, leírásokkal és adatokkal*) of *Great World Atlas* (*Nagy Világatlasz*), published in 2004 by Topográf–Nyír-Karta.



Colour relief shading in András Galácz's book Oceans and Polar Regions
Relief shading realized by József Sziládi according to the instructions of the author

This summary is a thesis-like review of more than twenty-five years of practical cartographical work and within this period almost twenty years of research experience that answers the question: why are the outlined courses started right now? The summary also answers the question brought up frequently: is it necessary for a Hungarian cartographer to deal with seas, to discuss cartographical delineation, description and nomenclature of submarine topographical features? The answer is simple: As an essential condition of correct cartographical representation, the map editor must have adequate knowledge on the area he must represent on maps. A regularly recurring task of Hungarian cartographers is the representation of the entire globe including oceans and seas. *For this reason, the cultivation of oceanography and the study of related disciplines is important for Hungarian cartography.*

This opinion of mine is supported by the textbook *General Physical Geography* (*Általános természetföldrajz)*, edited by *Zoltán Borsy* and published in 1993 by Nemzeti Tankönyvkiadó, that includes a mere 10-page chapter on *„The topography of the ocean floor"*, written by the editor himself. I quote one of his notions: *„Plenty of data prove more and more convincingly that we cannot explain the geological history of continents satisfactorily without studying ocean floor thoroughly"*. My conviction was also confirmed by Rudolf Czelnai's reflections on meteorology, his narrower profession, propounded in the preface of his above cited work:



Map with code numbers showing the limits of oceans and seas published in Great World Atlas (Nagy Világatlasz)

„In our rapidly integrating world, where international borders gradually lose importance, and new chances open continuously, our situation will shortly become similar to that we lived during the age of Austrian–Hungarian Monarchy. This means that our mind won't be confined by frontiers drawn around us in a distance of some hundred kilometres. In some areas, such as training of meteorologists, teaching physical oceanography on a high level will anyway be an important requirement in a few years…" I have a comment: this also applies to *scientists, teachers and students of geography, cartography and other earth sciences* as well as to fields of knowledge other than oceanography.

The objects of my scientific activity and the announced course

My object is collecting, systematically reviewing and synthesizing theoretical knowledge to help *practicing cartographers* solve tasks related to the cartographic representation of seas. As this knowledge is connected with several branches of disciplines, I hope that it can be utilized not only in the training of cartographers, but also in teaching students of other fields of geosciences, future geographers, geography teachers, possibly geologists and geophysicists – namely, *potential map users interested in geosciences*. I think there is a real chance of this idea, because I post more and more of my earlier publications on the homepage of the Department of Cartography and Geoinformatics of ELTE (at the URL http://lazarus.elte.hu/dolgozo/marton/mm_tan.htm). For scientists like me, who study special fields of knowledge involving relatively few researchers and practical experts, the World Wide Web facilitates a much more wide-ranging communication than earlier communication methods. Though in some cases our research results cannot be published in traditional paper-based books or periodicals, if there is an institution possessing a server and is ready to electronic publication, our results do not have to remain in the „table drawer".

A chronological review of the research

My interest in the profound study of this subject rose immediately after completing my university studies. Its source was the discordance between the image of dynamic sea, shown by plate tectonics theory I got familiar with during my studies, and the schematic, rough delineation of marine topography in maps seen during my practical work. The thesis I prepared when graduating from Eötvös Loránd University (*Tectonics of the Pannon Basin* and *Design of geophysical globes*) proved to be a good base for my subsequent research. At my first place of work, *Kartográfiai Vállalat*, the requirement to design good maps and the diversity of knowledge necessary for this encouraged me to continue my studies. Let me mention two publications of this period: *Gazetteers of geographical names in Hungary* (*Földrajzinév-tárak Magyarországon*, 1979) and *Representation of relief of sea and ocean floor on small-scale maps – practice and prospect* (*Az óceán- és tengerfenék-domborzat ábrázolása kisméretarányú térképeken – gyakorlat és lehetőségek*, 1984) were prized at the competition proclaimed by Országos Földügyi és Térképészeti Hivatal (National Office of Lands and Mapping). (The first publication, which deepened my knowledge on geographical names, derived from my daily work of that period: for five years I had taken part in the preparation of the gazetteer of Hungary, which contained 150 000 geographical names. The birth of the second one was considerably helped by the fact that, since 1984, beside my daily practical work at Kartográfiai Vállalat, I had the opportunity to superintend several research programmes, discussing correct cartographical representation of seafloor relief and creating the correct Hungarian nomenclature of marine feature names, following principles applied in international cartographical practice.) So could I finish my thesis for a university doctoral degree, the title of which was *Relief of sea and ocean floor. Representation of submarine relief on small-scale maps* (*Az óceán- és tengerfenék domborzata. Tenger alatti felszínek ábrázolása kisméretarányú térképeken*). The necessary theoretical background was provided by the technical and data library of Kartográfiai Vállalat, which possessed a great quantity of source material, and the departments of cartography and geophysics of Eötvös Loránd University.

My theses for university doctoral degree were consequently based on the first results of my experimental work, which was afterwards also supported by wide-ranging practical application. At the 1989 conference of the *International Cartographic Association* (*ICA*) in Budapest, the English version of the *detachable structural model of the Earth*, designed in 1988, was prized in the category of visual aid. The original Hungarian version of the 40 cm globe, published in 1986, also included the new representation of submarine relief. These globes, preceded by the *25 cm globe with relief colouration*, designed by me and published in Hungarian, English, German and Czech versions, received international interest. The structural globe itself was produced by the Department No. 2 of Map Edition of the company, under my direction, in accordance with Hajdu Lajos' innovative suggestion. As a result of this success, our country has taken part in the efforts of the *Commission on Marine Cartography of the International Cartographic Association*. One of my themes proposed for studying – the *Multilingual gazetteer of submarine relief features* (*A tengerfenék-domborzati képződmények több nyelvű névtára*) – was accepted….

Finishing the process for doctoral degree successfully provided further opportunities for me, including further assistance to my studies. I obtained a correspondence scholarship of „candidate" degree, announced by the Hungarian Academy of Sciences. As a result, Kartográfiai Vállalat supported the basic elaboration of all research topics included in my plan of studies. Thus I had the opportunity to design the map *The solid surface of the Earth* in Baranyi IV projection and to delineate the divided version of this projection. Regarding theoretical problems of relief representation, I attained important theoretical results in vertical and horizontal generalization; regarding toponymy, I succeeded in creating correct

Physical Globe of the Earth with a diameter of 25 cm Kartográfiai Vállalat, Budapest, 1985–1986

Detachable Globe of the Earth with a diameter of 40 cm won the prize of 'The best visual aid' in the Budapest conference of the International Cartographic Association in 1989. Kartográfiai Vállalat, Budapest, 1986

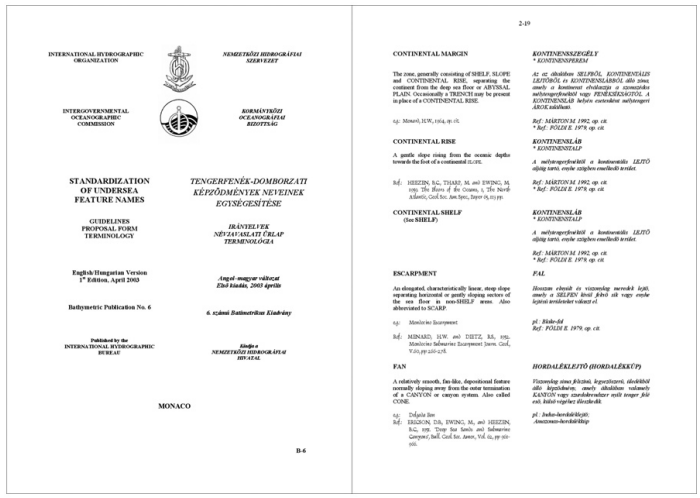
A section of the southern part of the North Atlantic Ridge. A part of the map „The solid surface of the Earth". Kartográfiai Vállalat, Budapest, 1990

Hungarian specific and generic terms for geographical names related to submarine relief. Another important result is the theoretical summary of experiences on gazetteers facilitating the correct use of geographical names. Continuing of the latter work, reckoning on further international interest, as an appendix of my candidature thesis I elaborated the *Gazetteer of the Arctic Ocean* (*A Jeges-tenger földrajzinév-tára*) along with the necessary maps. Besides the publications mentioned above, I also highly esteem the practical application of theoretical results in publications such as *World Atlas of Geography* (*Földrajzi Világatlasz*) of Kartográfiai Vállalat, where marine toponymy was significantly amplified soon in 1991 and 1995.

Map with code numbers showing the system of submarine relief features of the Arctic Ocean

My candidature thesis, finished with the title *Representation of undersea surfaces on small-scale maps* (*Tengervízzel fedett felszínek ábrázolása kisméretarányú térképeken*), was discussed in public at my workplace in May 1991, and the public degree examination took place in June 1992. In this period, since January 1992, I had already been a lecturer at the Department of Cartography of ELTE. This meant new challenges and new opportunities for me. The new educational tasks due to the change of technology that took place in cartography this time, made it necessary to attain knowledge on computerized cartography and geographical information systems. Based on this knowledge, and using results of graduating students directed by me, during the second third of 1990s we have collected the stuff for a *Multilingual gazetteer of the World Ocean* (*A Világtenger többnyelvű földrajzinév-tára*), the finishing of which was assisted by the Commission on Marine Cartography of International Cartographic Association. *András Dutkó*, who now collaborates with me in this Commission, wrote his degree thesis on this topic, and in the course of his Ph. D. studies he reworked the gazetteer into an electronic atlas under my supervision. Besides these studies, several diploma theses were prepared under my supervision in topics related to submarine morphology and cartographic representation of submarine features.

The creation of Hungarian categories and generic terms on submarine relief features is related to the international efforts to standardize geographical names, taking place within the framework of UNO. As a consequence of this, with the intermediation of the Commission on Marine Cartography of ICA I could establish a cooperation with the International Hydrographic Organization (IHO, Monaco), and, indirectly, with the Intergovernmental Oceanography Commission (IOC), as well as with the IHO–IOC corporation directing the publication of *General Bathymetric Chart of the Oceans* (*GEBCO*). By the 2001 conference of ICA in Beijing, we finished the first English-Hungarian version of *Standardization of Undersea Feature Names*… The original work, that expounds the principles of name standardization and the procedure of naming submarine features, was published in Monaco in several versions, each consisting of an English and a foreign language (French, German, Spanish, Russian, Chinese, Japanese) part; the English-Hungarian version is totally based on my previous research. The revised and enlarged final version, accepted also by the Hungarian inter-departmental Board on Geographical Names, was presented at the ICA conference in South Africa (Durban, August 2003), together with the CD version of the multilingual gazetteer. Of course, the latter works also include the results of András Dutkó's research.



INTERNATIONAL HYDROGRAPHIC ORGANIZATION

NEMZETKÖZI HIDROGRÁFIAI SZERVEZET

INTERGOVERNMENTAL OCEANOGRAPHIC COMMISSION

KORMÁNYKÖZI OCEANOGRÁFIAI BIZOTTSÁG

STANDARDIZATION OF UNDERSEA FEATURE NAMES

GUIDELINES PROPOSAL FORM TERMINOLOGY

TENGERFENÉK-DOMBORZATI KÉPZŐDMÉNYEK NEVEINEK EGYSÉGESÍTÉSE

IRÁNYELVEK NÉVJAVASLATI ŰRLAP TERMINOLÓGIA

English/Hungarian Version 1st Edition, April 2002

Angol–magyar változat Első kiadás, 2003 április

Bathymetric Publication No. 6

6. számú Batimetriai Kiadvány

Published by the INTERNATIONAL HYDROGRAPHIC BUREAU

Kiadja a NEMZETKÖZI HIDROGRÁFIAI HIVATAL

MONACO

B-6

2-19

CONTINENTAL MARGIN

The zone, generally consisting of SHELF, SLOPE and CONTINENTAL RISE, separating the continent from the deep sea floor or ABYSSAL PLAIN. Occasionally a TRENCH may be present in place of a CONTINENTAL RISE.

e.g. Menard, H.W., 1964, pp. 16.

Ref: HEEZEN, B.C., THARP, M. and EWING, M. 1959. The floors of the Oceans, 1. The North Atlantic, Geol. Soc. Am. Spec., Paper 65, 63 pp.

CONTINENTAL RISE

A gentle slope rising from the oceanic depths towards the foot of a continental SLOPE.

Ref: HEEZEN, B.C., THARP, M. and EWING, M. 1959. The floors of the Oceans, 1. The North Atlantic, Geol. Soc. Am. Spec., Paper 65, 63 pp.

CONTINENTAL SHELF (See SHELF)

ESCARPMENT

An elongated, characteristically linear, steep slope separating horizontal or gently sloping sectors of the sea floor in non-SHELF areas. Also abbreviated to SCARP.

e.g. Monterrey Escarpment

Ref: MENARD, H.W. and DIETZ, R.S., 1951. Monterrey Submarine Escarpment. Journ. Geol., V.59, pp 220-278.

FAN

A relatively smooth, fan-like, depositional feature normally sloping away from the outer termination of a CANYON or canyon system. Also called CONE.

e.g. Delgada fan

Ref: ERICSON, D.B., EWING, M., and HEEZEN, B.C., 1956. Deep Sea Sands. and Submarine Canyons', Bull. Geol. Soc. Amer., Vol. 67, pp 441-166.

KONTINENSSZEGÉLY * KONTINENSPEREM

Az az általában SELJRŐL, KONTINENTÁLIS LEJTŐRŐL és KONTINENSLÁBRÓL álló zóna, amely a kontinenst elválasztja a szomszédos mélytengerfenékétől vagy PENÉNYSÍKSÁGTÓL. A KONTINENSLÁB helyén esetenként mélytengeri ÁROK található.

Ref: MÁRTON M. 1992. op. cit. * Ref: FÖLDI E. 1978. op. cit.

KONTINENSLÁB * KONTINENSTALP

A mélytengerfenéktől a kontinentális LEJTŐ alsóig tartó, enyhe szögben emelkedő terület.

Ref: MÁRTON M. 1992. op. cit. * Ref: FÖLDI E. 1978. op. cit.

KONTINENSLÁB * KONTINENSTALP

A mélytengerfenéktől a kontinentális LEJTŐ alsóig tartó, enyhe szögben emelkedő terület.

Ref: MÁRTON M. 1992. op. cit. * Ref: FÖLDI E. 1978. op. cit.

FAL

Hosszan elnyúló és viszonylag meredek lejtő, amely a SELJRŐL lejtő alá vagy enyhe lejtésű területekre választ el.

pl.: Rhône-árok Ref: FÖLDI E. 1978. op. cit.

HORDALÉKLEJTŐ (HORDALÉKKÚP)

Viszonylag sima felszínű, legyezőszerű, üledékből álló lejtőalakzat, amely általában valamely KANYON vagy szárnyhálózatnak nyílt tenger felé eső, külső végéhez illeszkedik.

pl.: Indus-hordalékkúp; Amazonas-hordalékkúp

Title page and page 2-26 of the contemplated publication

My research related to seas, to nomenclature of submarine relief features and achievement of Hungarian generic terms, *served as an example for scientists of other disciplines*. For example, our results promoted the creation of Hungarian geographical names and terms to be used on maps related to *planetology*. Following the principles laid down by me, another Ph. D. student of my university, *Henrik Hargitai*, made a proposal on Hungarian professional terminology of planetology; he also delivered a lecture at the Durban conference mentioned above, eliciting positive reaction.

The use of my results can also be seen in the material of the dictionary and collection of rules of terminological orthography, *Orthography of geographical names* (*A földrajzi nevek helyesírása*), written by *Pál Fábián*, *Ervin Földi* and *Ede Hőnyi*, and published by Akadémiai Kiadó. This work includes „submarine topography" as a sixth „terminological group referring to the meaning of geographical generic terms"; the „list of examples of orthographical rules" – and therefore the rules themselves – also includes numerous submarine geographical names.

Utilization of results, tasks for the near future

Results obtained are *continuously utilized* in two fields: education and practical map edition.

1. In respect of practical work, my results contribute to a model of the Earth, which is more modern, approximates the solid surface of the Earth better, and whose „resolution" is appropriate for the scale used;
– describes the relief of (submarine) surface more accurately;
– provides a suggestive graphical representation of relief (this is true for the earlier isobathic /hypsometric/ colouration method, emphasizing continental slopes and mid-ocean ridges with a greenish blue tint, combined with grey relief shading, as well as for the new method of colour relief shading based on isobathic colouration);
– the network of Hungarian or partially Hungarian geographical names, which expresses the morphological characteristics more exactly, uses more generic terms than earlier methods and adapts well to international naming practice, facilitates a more exact identification of features on the map, reflecting the variety of relief better.

2. In some sense, practical usage includes the utilization of knowledge in education, at my lectures announced in Miskolc and Szeged. Of course, I have already given lectures about marine science during my courses for students of cartography and geography at Eötvös Loránd University, certainly much more briefly, „smuggled" into the topics of other courses. However, this educational usage also has scientific importance: it can be supposed with good reason that it will encourage others to do further research, or it will serve as an example for other fields of science. (As we have already seen, among others András Dutkó and Henrik Hargitai provide examples for both.)

3. At the meeting of the Commission on Marine Cartography of ICA in South Africa, the commission approved of my summary of the problems to be solved at the Department of Cartography and Geoinformatics during the following four years in the framework of the Commission.
– According to this approval, we should participate in a revaluation of limits of marine regions, which is now in progress involving several international organizations. This makes the „real-time" access of results possible, and perhaps we will be able to demonstrate the characteristic viewpoints of a country without sea.
– We should assemble a multilingual handbook of undersea relief feature types, following the example of the few handbook entries and map illustrations (because of volume limitations) on undersea relief features in *Magyar Nagylexikon* (*Great Hungarian Lexicon*), which entries and illustrations were written or drawn by me. We had the opportunity to make a presentation at the International Cartographic Conference in Spain in 2005.

4. I believe that cartographical synthesis, summary and „nationalization" of results of physical oceanography is very important. As a continuation of the 32 page chapter *Submarine topography with maps, descriptions and data* (*Tengerfenék-domborzat térképekkel, leírásokkal és adatokkal*) of *Great World Atlas* (*Nagy Világatlasz*), prepared by Topográf and published in 2004 by Nyír-Karta, we contemplate to prepare a textbook supplemented with 40 pages of thematic maps, now being negotiated with the publisher. This work should serve as a university atlas, issued as an independent publication, which should be available for the purposes of higher education and postgraduate training.